PB-239 597

WAPOGASSET LAKE, POLK COUNTY, WISCONSIN

Pacific Northwest Environmental Research Laboratory

Prepared for:

National Environmental Research Center
Wisconsin Department of Natural Resources
Wisconsin National Guard

November 1974

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1. REPORT NO.	2.	3. PB 239 597
4. TITLE AND SUBTITLE: Report on Wapogasset Lake, Polk County, Wisconsin		5. REPORT DATE: Prepared November 1974
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S): Anonymous (National Eutrophication Survey Staff)		8. PERFORMING ORGANIZATION REPORT NO.: Working Paper # 54
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Pacific Northwest Environmental Research Laboratory U.S.Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97330		10. PROGRAM ELEMENT NO.: 1BA029 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS: U.S. Environmental Protection Agency		13. TYPE OF REPORT AND PERIOD COVERED: Final - 1972 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES
Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114

16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

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NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

PRICES SUBJECT TO CHANGE

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report)	21. NO. OF PAGES
Release unlimited		38
	20. SECURITY CLASS (This page)	22. PRICE 3.75

EPA Form 2220-1 (9-73)

REPORT
ON
WAPOGASSET LAKE
POLK COUNTY
WISCONSIN
EPA REGION V
WORKING PAPER No. 54

WITH THE COOPERATION OF THE
WISCONSIN DEPARTMENT OF NATURAL RESOURCES
AND THE
WISCONSIN NATIONAL GUARD
NOVEMBER, 1974

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Wisconsin Department of Natural Resources for professional involvement and to the Wisconsin National Guard for conduct of the tributary sampling phase of the Survey.

Francis H. Schraufnagel, Acting Assistant Director, and Joseph R. Ball of the Bureau of Water Quality, and Donald R. Winter, Lake Rehabilitation Program, provided invaluable lake documentation and counsel during the Survey. Central Office and District Office personnel of the Department of Natural Resources reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper series.

Major General James J. Lison, Jr., the Adjutant General of Wisconsin, and Project Officer CW-4 Donald D. Erickson, who directed the volunteer efforts of the Wisconsin National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

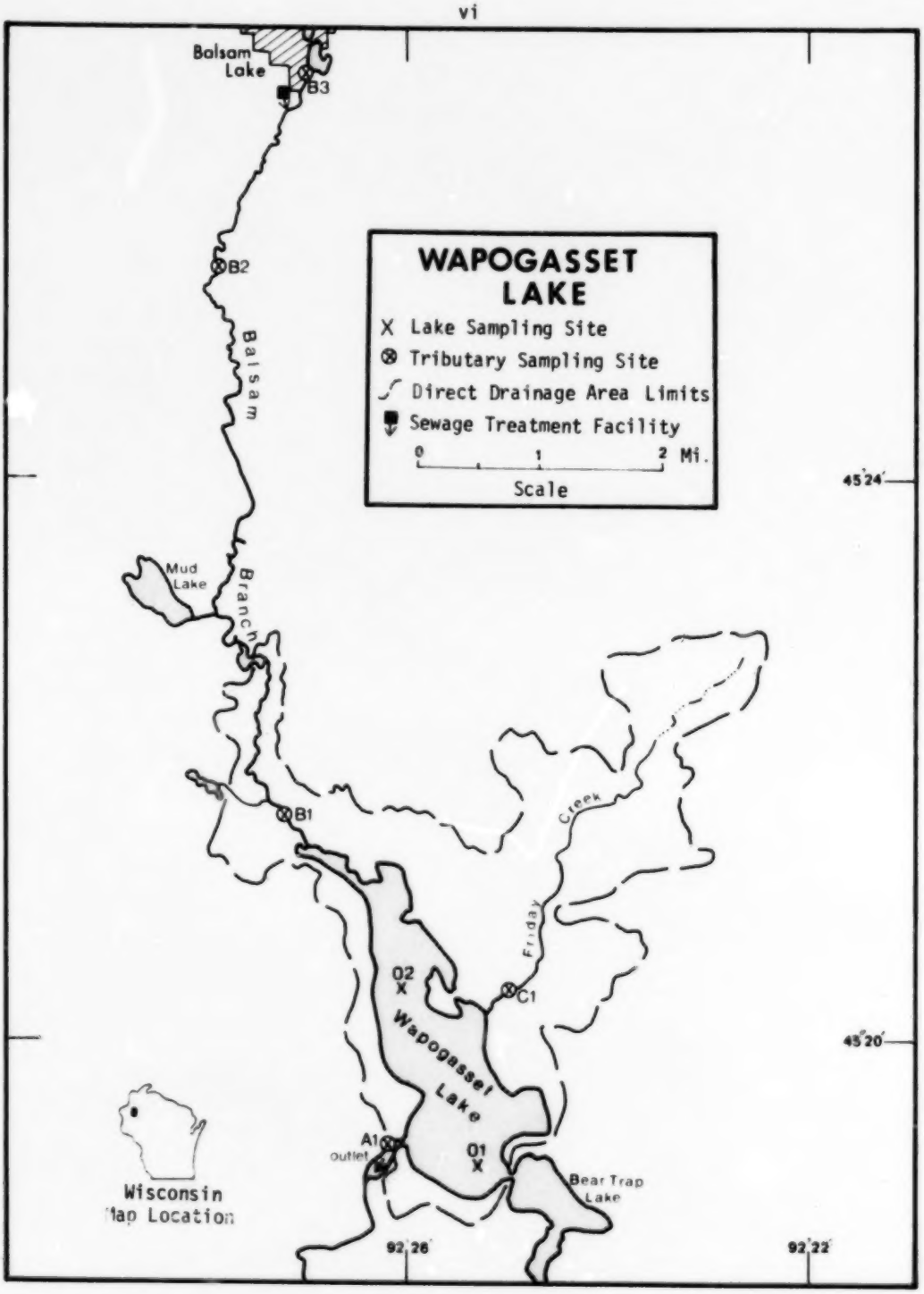
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF WISCONSIN

LAKE NAME	COUNTY
Altoona	Eau Claire
Beaver Dam	Barron
Beaver Dam	Dodge
Big Eau Pleine	Marathon
Browns	Racine
Butte des Morts	Winnebago
Butternut	Price, Ashland
Castle Rock Flowage	Juneau
Como	Walworth
Crystal	Vilas
Delavan	Walworth
Eau Claire	Eau Claire
Geneva	Walworth
Grand	Green Lake
Green	Green Lake
Kegonsa	Dane
Koshkonong	Jefferson, Rock, Dane
Lac La Belle	Waukesha
Middle	Walworth
Nagawicka	Waukesha
Oconomowoc	Waukesha
Okauchee	Waukesha
Petenwell Flowage	Juneau
Pewaukee	Waukesha
Pigeon	Waupaca
Pine	Waukesha
Poygan	Winnebago, Waushara
Rock	Jefferson
Rome Pond	Jefferson, Waukesha
Round	Waupaca
Shawano	Shawano

LAKE NAME	COUNTY
Sinnissippi	Dodge
Swan	Columbia
Tainter	Dunn
Tichigan	Racine
Townline	Oneida
Trout	Vilas
Wapogassett	Polk
Wausau	Marathon
Willow	Oneida
Winnebago	Winnebago, Fond Du Lac, Calumet
Wisconsin	Columbia
Wissota	Chippewa
Yellow	Burnett


Balsam Lake
B3
B2
Balsam Branch
Mud Lake
B1
Creek
Friday
C1
O2
Wapogasset Lake
A1
Outlet
O1
Bear Trap Lake
WAPOGASSET LAKE
Lake Sampling Site
Tributary Sampling Site
Direct Drainage Area Limits
Sewage Treatment Facility
0 1 2 Mi.
Scale
45°24'
45°20'
92°26'
92°22'
Wisconsin
Map Location

WAPOGASSET LAKE

STORET NO. 5550

I. CONCLUSIONS

A. Trophic Condition:

Survey data and the records of others indicate Wapogasset Lake is eutrophic.

B. Rate-Limiting Nutrient:

Results of the algal assay indicate Wapogasset Lake was co-limited by nitrogen and phosphorus at the time the sample was collected. Lake data indicate clear N-limitation at the other sampling times.

C. Nutrient Controllability:

1. Point sources--During the sampling year, Wapogasset Lake received a phosphorus load at a rate somewhat greater than that proposed by Vollenweider (in press) as "dangerous"; i.e., a eutrophic rate (see page 16). Of this load, the Village of Balsam Lake is estimated to have contributed nearly 22%.

The total phosphorus loading rates that can be achieved by specified levels of phosphorus removal at the Balsam Lake plant, as compared to Vollenweider's suggested rates, are:

	Total P Loading Rate	
% P Removal	lbs/acre/yr	$g/m^2/yr$
Existing	6.3	0.71
50	5.7	0.64
70	5.4	0.60
80	5.3	0.59
90	5.1	0.57
100	5.0	0.56

Vollenweider:	
"Dangerous" (eutrophic rate)	0.62
"Permissible" (oligotrophic rate)	0.31

While none of the removal options would result in an oligotrophic loading rate, it is calculated that 70% or more phosphorus removal at the Village of Balsam Lake would reduce the loading to less than a eutrophic rate and should improve the trophic condition of the lake after a new phosphorus equilibrium has been established.

The waste discharge permit recently issued to the Village of Balsam Lake by the Wisconsin Department of Natural Resources requires upgrading of the waste treatment plant by July 1, 1977. Reportedly (Kozel, 1974), a new plant will be constructed with final effluent disposal in a seepage lagoon.

2. Non-point sources (see page 16)--The calculated nutrient exports of Balsam Branch during the sampling year are quite low and may indicate some overestimation of the point-source loads. However, even if none of the nutrient loads measured in Balsam Branch are attributed to the point source, the exports would still be a relatively low 61 lbs P and 811 lbs $N/mi^2/yr$.

On the other hand, the nutrient exports of presumably unimpacted Friday Creek may appear to be somewhat high. However,

they are similar to the exports calculated for the Kinnickinnic River elsewhere in the St. Croix River drainage (i.e., 104 lbs P and 2,694 lbs N/mi^2/yr).

In all, non-point sources are estimated to have contributed about 76% of the total phosphorus load to Wapogasset Lake during the sampling year.

II. INTRODUCTION

Wapogasset Lake is in the Apple River basin of the south central St. Croix River drainage system. Land use in the basin is primarily agricultural with dairying predominant. Industry in the area is largely the production of dairy products.

Wapogasset Lake receives rather intensive recreational use, and pleasure boating is said to be reaching problem proportions (Sather and Threinen, 1961). Other uses are swimming and fishing. Game fish present are northern pike, walleyes, largemouth bass, and panfish.

Four resorts and two boat liveries offer services, and a number of public access sites are provided.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry*:

1. Surface area: 1,186 acres.
2. Mean depth: 17.3 feet.
3. Maximum depth: 32 feet.
4. Volume: 20,469 acre/feet.
5. Mean hydraulic retention time: 194 days.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area†	Mean flow†
Balsam Branch	78.9 mi^2	42.7 cfs
Friday Creek	9.8 mi^2	5.0 cfs
Minor tributaries & immediate drainage -	8.6 mi^2	5.6 cfs
Totals	97.3 mi^2	53.3 cfs

2. Outlet -

Sucker Branch of Apple River	99.1 mi^{2}††	53.3 cfs

C. Precipitation†††:

1. Year of sampling: 33.4 inches.
2. Mean annual: 28.1 inches.

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* Ball, 1974.
† Drainage areas are accurate within ±0.5%; mean daily flows are accurate within ±40%; mean monthly flows are accurate within ±35%; and normalized monthly flows are accurate within ±35%.
†† Includes area of lake.
††† See Working Paper No. 1, "Survey Methods".

IV. LAKE WATER QUALITY SUMMARY

Wapogasset Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two stations on the lake and from a number of depths at each station (see map, page vi). During each visit, a single depth-integrated (15 feet to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 22 feet at station 1 and 20 feet at station 2.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (11/03/72)		
Temperature (Cent.)	5.4	5.5	5.4	5.6
Dissolved oxygen (mg/l)	10.1	10.9	10.5	13.2
Conductivity (μmhos)	190	193	193	198
pH (units)	7.7	7.8	7.8	7.8
Alkalinity (mg/l)	83	84	84	86
Total P (mg/l)	0.027	0.044	0.039	0.063
Dissolved P (mg/l)	0.013	0.016	0.015	0.020
NO_2 + NO_3 (mg/l)	0.160	0.174	0.175	0.190
Ammonia (mg/l)	0.040	0.049	0.050	0.060
		ALL VALUES		
Secchi disc (inches)	42	71	60	120

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
06/26/72	1. Oscillatoria	132
	2. Anabaena	128
	3. Melosira	58
	4. Microcystis	47
	5. Fragilaria	32
	6. Chroococcus	31
	Other genera	145
	Total	573
08/26/72	1. Anabaena	2,899
	2. Dinobryon	2,065
	3. Fragilaria	1,268
	4. Synura	507
	5. Gloeocapsa	471
	Other genera	1,993
	Total	9,203
11/03/72	1. Melosira	1,284
	2. Dinobryon	524
	3. Cyclotella	289
	4. Oscillatoria	253
	5. Cryptomonas	199
	Other genera	1,068
	Total	3,617

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
06/26/72	01	7.8
	02	15.7
08/26/72	01	19.7
	02	35.2
11/03/72	01	9.3
	02	11.9

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.017	0.220	5.5
0.006 P	0.023	0.220	5.5
0.012 P	0.029	0.220	5.4
0.024 P	0.041	0.220	5.7
0.060 P	0.077	0.220	5.6
0.060 P + 10.0 N	0.077	10.220	33.9
10.0 N	0.017	10.220	6.4

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Wapogasset Lake was moderately high at the time the sample was collected.

Yield responses to nutrient spikes indicate the lake was co-limited by nitrogen and phosphorus during the November

sampling (it is noted that there was no loss of either nutrient between the time the sample was collected and the assay was begun).

The N/P ratio of the control was a borderline 13/1. Note that the addition of successive spikes of orthophosphorus resulted in yields not significantly different than the control yield until nitrogen was also added. Also note that though the yield resulting from the addition of only nitrogen was significantly greater than the control yield, the difference was minimal.

Lake data indicate nitrogen limitation at the other sampling times. The N/P ratios were 10/1 and 7/1 for the June and August samplings respectively.

D. Trophic Condition:

Survey data and observations and the records of others indicate Wapogasset Lake is eutrophic. Survey limnologists observed an algal bloom in progress in June and noted that rather heavy growths of aquatic vegetation occupied much of the littoral zone of the lake. According to Department of Natural Resource records, frequent efforts have been made to chemically control weeds and, to a lesser extent, algae (Leuschow, 1972).

Of the 46 Wisconsin lakes studied, 16 had less mean total phosphorus, 14 had less mean dissolved phosphorus, 28 had less mean chlorophyll *a*, 25 had lower algal assay control yields, but only 9 had less mean inorganic nitrogen.

V. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the Wisconsin National Guard collected a monthly near-surface grab sample from each of the tributary sites indicated on the map (page vi), except for the high runoff months of April and May when two samples were collected. Sampling was begun in September, 1972, and was completed in August, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Wisconsin District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were calculated using the mean concentrations in Friday Creek at station C-1 and the mean ZZ flow.

The Village of Balsam Lake declined participation in the Survey, and nutrient loads attributable to that source were estimated at 2.5 lbs P and 7.5 lbs N/capita/year.

Another municipal source, the Village of Milltown, is located upstream from the Village of Balsam Lake within the 25-mile limit of the Survey. However, the effluent of this primary STP is discharged to a

marsh, and any nutrients leaving the marsh would be further reduced in the intervening Rice Lake and Balsam Lake before reaching Wapogasset Lake. Therefore, it is assumed that nutrients from the Village of Milltown have little, if any, effect on Wapogasset Lake.

In the following loading tables, the nutrient loads shown for Balsam Branch do not include the loads estimated for the Village of Balsam Lake.

A. Waste Sources:

1. Known municipal -

Name	Pop. Served	Treatment	Mean Flow (mgd)	Receiving Water
Balsam Lake	648*	Primary	0.065**	Balsam Branch

2. Known industrial - None

* 1970 Census.
** Estimated at 100 gal/capita/day

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Balsam Branch	3,190	42.4
Friday Creek	1,150	15.3
b. Minor tributaries & immediate drainage (non-point load) -	1,220	16.2
c. Known municipal -		
Balsam Lake	1,620	21.5
d. Septic tanks* -	170	2.2
e. Known industrial - None	-	-
f. Direct precipitation** -	180	2.4
Total	7,530	100.0

2. Outputs -

Lake outlet - Sucker Branch 4,280

3. Net annual P accumulation - 3,250 lbs.

* Four resorts, 220 dwellings, and 1 camp on lakeshore (Ball, 1974); see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Balsam Branch	59,130	50.4
Friday Creek	15,940	13.6
b. Minor tributaries & immediate drainage (non-point load) -	19,660	16.8
c. Known municipal -		
Balsam Lake	4,860	4.2
d. Septic tanks* -	6,270	5.3
e. Known industrial - None	-	-
f. Direct precipitation** -	11,430	9.7
Total	117,290	100.0

2. Outputs -

Lake outlet - Sucker Branch 116,850

3. Net annual N accumulation - 440 lbs.

* Four resorts, 220 dwellings, and one camp on lakeshore (Ball, 1974); see Working Paper No. 1.
** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr
Balsam Branch	40	749
Friday Creek	117	1,627

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutropnic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	6.3	2.7	98.9	0.4
grams/m^2/yr	0.71	0.30	11.1	<0.1

Vollenweider loading rates for phosphorus (g/m^2/yr) based on mean depth and mean hydraulic retention time of Wapogasset Lake:

"Dangerous" (eutrophic rate)	0.62
"Permissible" (oligotrophic rate)	0.31

VI. LITERATURE REVIEWED

Anonymous, 1972. Wisconsin lakes. Publ. 218-72, Dept. of Natural Resources, Madison.

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VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR WISCONSIN 9/30/74

LAKE CODE 5550 WAPOGASETT LAKE

TOTAL DRAINAGE AREA OF LAKE 99.10

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
5550A1	99.10	18.70	41.40	72.00	128.30	59.20	81.90	49.30	35.50	45.40	45.40	37.50	26.60	53.31
5550B1	78.90	15.00	34.00	57.00	100.00	49.00	66.00	40.00	29.00	38.00	36.00	29.00	21.00	42.74
5550C1	9.76	1.80	4.50	7.00	11.00	5.20	7.20	4.60	3.60	4.50	4.60	3.60	2.40	4.99
5550Z2	10.40	2.00	4.40	7.60	13.00	6.30	8.70	5.20	3.80	4.80	4.80	4.00	2.80	5.60

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 99.10
SUM OF SUB-DRAINAGE AREAS = 99.06

TOTAL FLOW IN = 641.40
TOTAL FLOW OUT = 641.20

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
5550A1	9	72	42.00	24	41.00				
	10	72	50.00	8	55.00				
	11	72	50.00						
	12	72	37.00	2	36.00				
	1	73	46.00						
	2	73	44.00	3	51.00				
	3	73	135.00	5	54.00				
	4	73	180.00	8	160.00	25	180.00		
	5	73	240.00	6	220.00	21	110.00		
	6	73	110.00	21	88.00				
	7	73	56.00	5	56.00				
	8	73	70.00	12	67.00				
5550B1	9	72	31.00	24	31.00				
	10	72	37.00	8	41.00				
	11	72	38.00						
	12	72	26.00	2	27.00				
	1	73	35.00						
	2	73	34.00	3	39.00				
	3	73	105.00	5	41.00				
	4	73	160.00	8	140.00	25	150.00		
	5	73	210.00	6	190.00	21	92.00		
	6	73	90.00	21	74.00				
	7	73	46.00	5	46.00				
	8	73	58.00	12	56.00				

TRIBUTARY FLOW INFORMATION FOR WISCONSIN 9/30/74

LAKE CODE 5550 WAPOGASETT LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
5550C1	9	72	2.00	24	2.00				
	10	72	2.40	8	2.60				
	11	72	2.40						
	12	72	1.80	2	1.70				
	1	73	3.00						
	2	73	2.90	3	3.40				
	3	73	9.00	5	3.60				
	4	73	47.00	8	39.00	25	47.00		
	5	73	60.00	6	58.00	21	18.00		
	6	73	17.00	21	14.00				
	7	73	6.30	5	6.30				
	8	73	10.00	12	10.00				
5550ZZ	9	72	2.20	24	2.10				
	10	72	2.60	8	2.80				
	11	72	2.70						
	12	72	1.90	2	1.80				
	1	73	3.20						
	2	73	3.10	3	3.60				
	3	73	9.70	5	3.80				
	4	73	49.00	8	41.00	25	45.00		
	5	73	64.00	6	56.00	21	19.00		
	6	73	18.00	21	14.00				
	7	73	6.70	5	6.70				
	8	73	11.00	12	11.00				

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/09/30

555001
45 19 00.0 092 25 20.0
WAPOGASSET LAKE
55 WISCONSIN

11EPALES
5

2111202
0013 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/26	11 35	0000	21.6		48	220	8.80	96	0.050	0.060	0.024	0.014
	11 35	0012	19.3	7.8		220	8.20	95	0.040	0.070	0.017	0.012
72/08/26	09 00	0000			48	198	8.75	92	0.060	0.120	0.031	0.013
	09 00	0004	20.8	6.8		198	8.70	94	0.050	0.120	0.046	0.013
	09 00	0010	20.8	6.5		198	8.73	93	0.050	0.120	0.035	0.013
	09 00	0015	20.7	5.0		200	8.60	94	0.050	0.200	0.042	0.018
	09 00	0022	20.5			210	7.45	97	0.040	0.460	0.086	0.066
72/11/03	15 00	0000			96	193	7.80	84	0.180	0.040	0.033	0.017
	15 00	0004	5.6	10.6		190	7.80	84	0.180	0.050	0.030	0.018
	15 00	0014	5.5	10.4		190	7.80	85	0.180	0.040	0.045	0.020
	15 00	0019	5.6	10.1		198	7.80	84	0.190	0.060	0.062	0.015

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/26	11 35	0000	7.8J
72/08/26	09 00	0000	19.7J
72/11/03	15 00	0000	9.3J

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 74/09/30

555002
45 20 00.0 092 26 00.0
WAPOGASSET LAKE
55 WISCONSIN

11EPALES 2111202
5 0018 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/26	12 05	0000	20.8		72	220	8.70	93	0.050	0.120	0.029	0.013
	12 05	0018	18.9	8.0		220	8.20					
72/08/26	09 25	0000			42	180	8.71	93	0.060	0.090	0.059	0.015
	09 25	0004	20.5	7.4		180	8.75	91	0.070	0.100	0.061	0.017
	09 25	0015	20.5	7.1		180	8.70	92	0.060	0.180	0.150	0.059
	09 25	0020	20.2	5.6		183	8.50	94	0.060	0.020	0.140	0.074
72/11/03	15 15	0000			120	193	7.80	86	0.160	0.050	0.027	0.016
	15 15	0004	5.4	13.2		193	7.80	85	0.160	0.040	0.029	0.015
	15 15	0014	5.4	10.2		195	7.70	84	0.170	0.060	0.061	0.013
	15 15	0019	5.4	10.9		195	7.70	83	0.170	0.050	0.063	0.014

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/26	12 05	0000	15.7J
72/08/26	09 25	0000	35.2J
72/11/03	15 15	0000	11.9J

J VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/10/02

5550A1 L5550A1
45 19 30.0 092 26 30.0
SUCKER BRANCH (APPLE RIVER)
55 15 BALSAM LAKE
O/NAPOGASSETT LAKE
CO HWY F BRDG 1.5 MI NNW OFDERONDA
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	15 30		0.039	0.800	0.070	0.015	0.072
72/10/08	13 30		0.088	0.700	0.087	0.026	0.061
72/11/04	11 45		1.660	0.500	0.013	0.019	0.033
72/12/02	11 50		0.250	0.880	0.012	0.008	0.031
73/01/06	14 45		0.260	0.720	0.044	0.008	0.030
73/02/03	14 40		0.290	0.540	0.033	0.019	0.030
73/03/05	14 05		0.350	0.400	0.042	0.015	0.025
73/04/08	13 30		0.198	1.100	0.016	0.005K	0.050
73/04/25	12 45		0.088	1.100	0.015	0.007	0.030
73/05/06	12 20		0.054	0.540	0.018	0.009	0.025
73/05/21	09 15		0.019	1.890	0.063	0.013	0.040
73/06/21	12 15		0.126	0.540	0.007	0.006	0.035
73/07/05	12 40		0.010K	0.650	0.012	0.022	0.030
73/08/12	14 20		0.016	1.380	0.016	0.010	0.055

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/10/02

5550B1 LS5550B1
45 21 30.0 092 27 30.0
BALSAM BRANCH
55 15 BALSAM LAKE
T/WAPOGASSETT LAKE
CO RD XING UPSTREAM OF C O TRUNK C BRD
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	14 30		0.291	0.500	0.092	0.012	0.052
72/10/08	13 00		0.143	0.450	0.075	0.021	0.050
72/11/04	10 45		0.168	0.700	0.032	0.018	0.046
72/12/02	11 30		0.220	0.560	0.036	0.011	0.035
73/01/06	14 30		0.290	0.560	0.078	0.014	0.040
73/02/03	14 25		0.270	0.480	0.056	0.011	0.035
73/03/05	13 45		0.410	2.400	0.775	0.080	
73/04/08	13 45		0.046	0.580	0.009	0.008	0.050
73/04/25	13 10		0.017	0.480	0.007	0.014	0.040
73/05/06	12 00		0.024	0.540	0.023	0.018	0.045
73/05/21	08 45		0.039	0.690	0.050	0.032	0.075
73/06/21	12 35		0.096	0.520	0.105	0.006	0.080
73/07/05	13 00		0.035	0.830	0.198	0.054	0.095
73/09/12	14 00		0.069	1.100	0.044	0.042	0.072

STORET RETRIEVAL DATE 74/10/02

555082 LS555082
45 25 30.0 092 28 00.0
BALSAM BRANCH
55 15 BALSAM LAKE
T/WAPOGASSETT LAKE
CO RD XING SE OF BALSAM LAKE BELO STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	14 50		0.090	0.700	0.057	0.005K	0.046
72/10/08	13 00		0.180	1.000	0.132	0.018	0.052
72/11/04	10 00		0.115	0.420	0.020	0.016	0.037
72/12/02	11 00		0.180	0.830	0.027	0.014	0.046
73/01/06	14 10		0.198	1.250	0.048	0.018	0.040
73/02/03	14 00		0.189	0.540	0.035	0.016	0.035
73/03/05	12 50		0.530	0.610	0.138	0.036	0.070
73/04/08	12 30		0.100	2.200	0.063	0.011	0.045
73/04/25	14 20		0.061	0.580	0.025	0.019	0.045
73/05/06	11 35		0.115	0.560	0.048	0.026	0.047
73/05/21	08 15		0.168	1.700	0.150	0.039	0.082
73/06/23	12 50		0.580	0.540	0.100	0.007	0.050
73/07/05	13 15		0.058	0.540	0.042	0.025	0.055
73/09/12	13 40		0.290	0.720	0.058	0.058	0.095

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/10/02

555083 LS555083
45 27 00.0 092 27 00.0
BALSAM BRANCH
55 15 BALSAM LAKE
T/WAPOGASSETT LAKE
CO RD XING OUTLET BELOW BALSAM LAKE STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	15 00		0.016	0.700	0.024	0.009	0.029
72/10/08	13 30		0.110	1.200	0.107	0.006	0.042
72/11/04	10 30		0.025	0.560	0.007	0.005K	0.020
72/12/02	11 15		0.068	0.850	0.014	0.007	0.021
73/01/06	14 15		0.084	0.460	0.055	0.011	0.025
73/02/03	14 05		0.110	0.325	0.046	0.017	0.020
73/03/05	12 35		0.160	2.310	0.040	0.014	0.020
73/04/08	13 00		0.066	2.000	0.072	0.006	0.035
73/04/25	13 40		0.010K	0.750	0.005K	0.005K	0.020
73/05/06	11 45		0.029	1.760	0.061	0.013	0.030
73/05/21	08 30		0.021	1.980	0.110	0.017	0.035
73/06/21	13 00		0.310	0.720	0.028	0.018	0.030
73/07/05	13 20		0.010K	0.480	0.021	0.005K	0.020
73/08/12	13 45		0.017	0.600	0.038	0.008	0.045

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/10/02

5550C1 LS5550C1
45 20 30.0 092 25 00.0
FRIDAY CREEK
55 15 HALSAM LAKE
T/WAPOGASSETT LAKE
CO TRUNK C XING NEAR CMP ICAGHOWAN
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/24	14	15	0.130	1.350	0.055	0.005K	0.087
72/10/08	13	00	0.420	0.950	0.168	0.032	0.085
72/11/04	11	15	0.289	0.960	0.026	0.027	0.050
72/12/02	11	40	0.960	1.000	0.050	0.018	0.052
73/01/06	14	45	1.100	0.580	0.126	0.028	0.055
73/02/03	14	35	1.140	0.600	0.072	0.027	0.045
73/03/05	13	40	1.260	3.300	0.630	0.110	0.200
73/04/08	12	45	0.410	0.795	0.018	0.022	0.055
73/04/25	13	00	0.357	0.780	0.018	0.036	0.065
73/05/06	12	10	0.336	0.980	0.048	0.030	0.060
73/05/21	09	00	0.280	2.800	0.099	0.052	0.240
73/06/21	12	25	0.336	0.940	0.036	0.044	0.170
73/07/05	12	50	0.540	1.000	0.069	0.154	0.260
73/08/12	14	10	0.560	0.810	0.046	0.074	0.130

K VALUE KNOWN TO BE LESS THAN INDICATED